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# *Asclepias jorgeana* (Asclepiadaceae), a New Milkweed from Montane Western Mexico

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**ABSTRACT.** A new milkweed, *Asclepias jorgeana*, from pine-oak forests of Chihuahua, Sonora, Durango, and Guanajuato, Mexico, is described and illustrated. It appears to be related to *A. pringlei* (Greenman) Woodson, which occurs mostly to the south and east of *A. jorgeana*; however, they occur sympatrically in Durango. The new species is distinguished from *A. pringlei* by attenuate corona hoods, erect, fusiform follicles, and comose seeds. Although the new species has been collected several times since 1946, specimens have remained unidentified or have been determined to be hybrids or an undescribed species.

In preparing a treatment of Asclepiadaceae for the revision of Howard Scott Gentry's *Rio Mayo Plants* (Martin et al., 1998), the first author examined several collections of *Asclepias* that could not be assigned to any known species. Contemporaneously, the second author also determined that several herbarium specimens under study from Durango represented an undescribed species of *Asclepias*. Independent study of this plant in the field by both authors and subsequent discussions confirmed the identity and distinctiveness of these populations, which we describe here as a new species.

***Asclepias jorgeana*** Fishbein & S. P. Lynch, sp. nov. TYPE: Mexico. Chihuahua: Cascada de Basaseáchic, 28°10'20"N, 108°13'W, 1950 m, approx. 100 m upstream from the top of the falls, above the trail, on steep, shaded, moist, SE-facing, rocky slope, 5 July 1994, M. Fishbein 1789, S. McMahon, G. Ferguson, R. Felger, M. Wilson (holotype, ARIZ; isotype, MEXU). Figure 1A–H.

Herba e radice fibrosa. Caulis simplex erectus. Folia opposita petiolata parce puberula; lamina elliptico-ovali

vel ovata, maxima 45–123 mm longa, 15–61 mm lata; petiolo 5–16 mm longo. Umbellae 1–5 extra-axillares vel ut videtur terminales, 7–26-florales; pedunculo 10–40 mm longo; pedicello 12.5–22.5 mm longo. Calyx viridis; lobis reflexis, 1.75 mm longis. Corolla viridis saepe obscure roseolo-brunnea suffusa; lobis reflexis, 4.75–6.5 mm longis. Corona e 5 cucullis pallido-lavandulis vel albis, stipitatis fere erectis, 3.75–4.75 mm longis composita. Corniculi ad medium cucullis adnati, arcuati exserti. Columna 0.8–1.25 mm longa. Folliculus erectus in pedicello reflexo, fusiformis. Semina ovalia comosa.

Perennial herb 20–50 cm tall from fibrous rootstock. Stem single from base, unbranched, puberulent in lines or hairs scattered around the stem. Leaves opposite, decussate, simple; lowest pair 17.5–62.5 mm long and 10–27.5 mm wide, the largest 45–123 mm long and 15–61 mm wide, becoming reduced and sessile in the inflorescence; blades elliptic-oval to ovate, the apex acute, the margin entire, ciliate, decurrent on the petiole (especially pronounced in southern populations; Fig. 1A), the base acute to rounded, appearing subcordate in southern populations (Fig. 1A), puberulent on veins below, sparsely pubescent throughout above, the venation reticulodromous, with 3–10 tan to dark brown, glandular, multicellular trichomes ("collecters") borne at the base of the midvein above, membranous, bright green above, paler below; petioles 5–16 mm; stipules absent, several glands (collecters) similar to those on the blade in their position. Inflorescence of 1–5 umbels adjacent to upper leaf axils and also apparently terminal, on peduncles 10–40 mm long; umbels of 7–26 flowers on puberulent pedicels 12.5–22.5 mm long. Flowers hermaphroditic, 10–12.5 mm long from tip of reflexed corolla lobe to corona tip; calyx synsepalous, green, the tube very short, the 5 reflexed lobes 1.75 mm long; corolla sympetalous, green often suffused with dull pinkish brown, the tube short, the 5 reflexed lobes 4.75–6.5 mm long; stamens 5, ad-



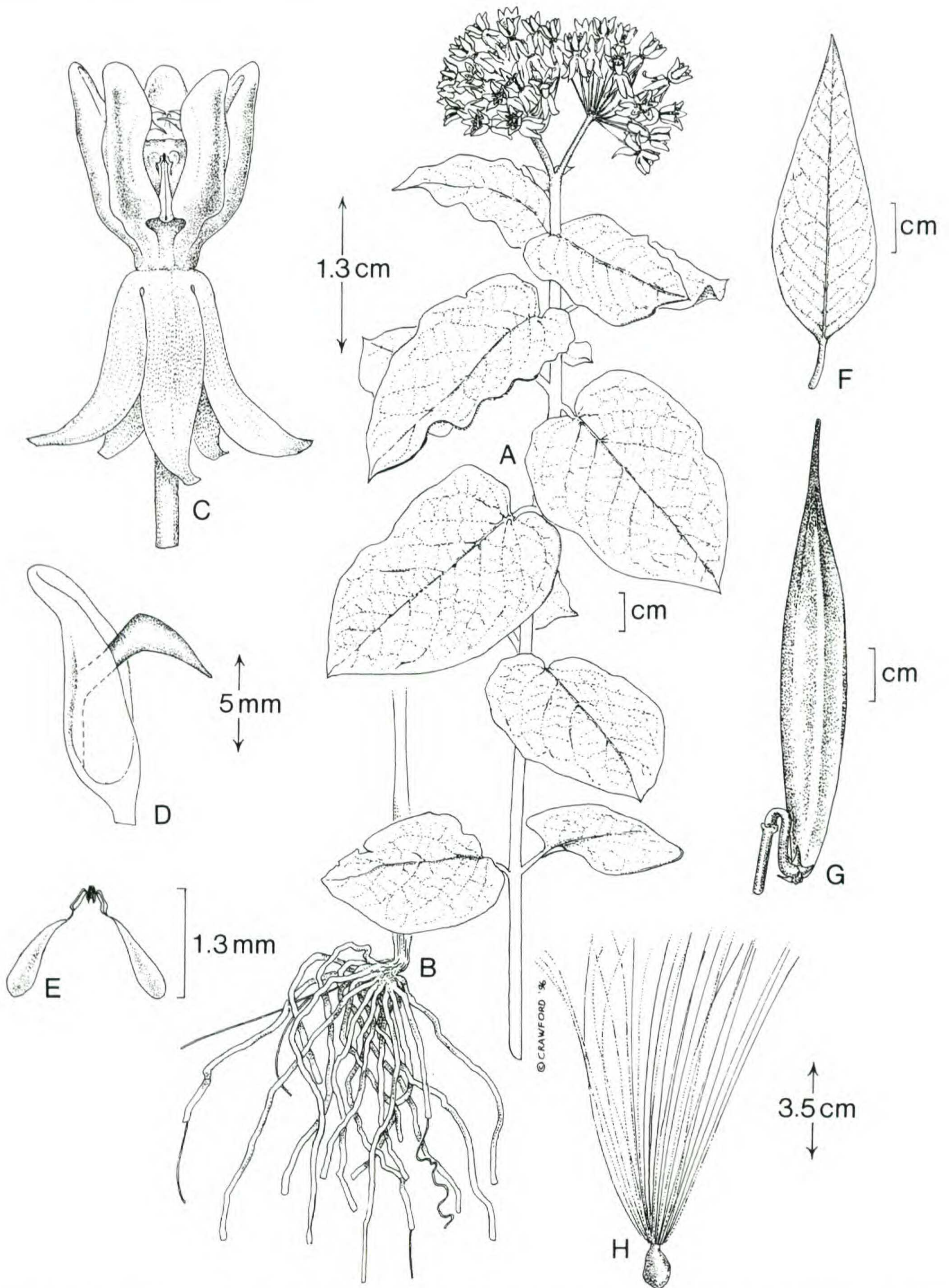


Figure 1. *Asclepias jorgeana* Fishbein & S. P. Lynch. —A. Habit, showing broad leaves characteristic of Durango populations. —B. Roots. —C. Flower. —D. Corona segment (hood with protruding horn), lateral view. —E. Pollinarium. —F. Narrow leaf characteristic of northern populations. —G. Follicle. —H. Seed. Based on Lynch 14175 (LSUS), Fishbein 1789 (ARIZ, MEXU), and photos.



nate to the common style apex of the two carpels to form a gynostegium, the column composed of connate stamen filaments 0.8–1.25 mm long, cylindrical or slightly obconic; corona of 5 distinct segments (hoods) arising from the top of the column at the attachment of the anthers, the hoods nearly erect to spreading, stipitate, cup-shaped, dorsally flattened, with entire margin, truncate basally, obtuse and rounded apically, 3.75–4.75 mm long, surpassing the anther-style head, pale lavender to white, bearing a narrowly falcate appendage (horn) within, the horns adnate to hoods from the base to midway up the segment and abruptly curving over the anther-style head, sometimes geniculate near the point of egress from the hood; anther-style head narrowly cylindrical, 2.25–2.5 mm long, the anthers bithecaous with one fertile cell per theca, bearing corneous marginal appendages (wings) widest at base and scarious, ovate-lanceolate, apical appendages, 0.5 mm long, pollen grains in each anther cell embedded in a waxy matrix forming a pollinium; pollinia lacrimiform, 1.25 mm long, those of adjacent anthers united by a translator with arms 0.3 mm long; gynoecium of 2 carpels, the ovaries free, the styles connate their entire length, abruptly expanded apically and fused to anthers, the stigmas 5, borne below the style apex. Fruits follicular, 8 cm long, fusiform, apically acuminate, borne erect on deflexed pedicels. Seeds narrowly ovate, compressed, narrowly winged, 6.2–6.5 mm long, bearing an apical tuft of bright white hairs 2.5–4.5 cm long.

**Etymology.** This species is named in honor of George Ferguson, a broadly knowledgeable naturalist who has introduced the first author to many fine places in the Río Mayo region. He has collected several specimens of the new species, which, like George, is at home in the wild, rugged canyons of the pine-oak forest.

**Distribution and habitat.** *Asclepias jorgeana* is known from west-central Chihuahua and adjacent Sonora, western Durango (prominently along the Durango–Mazatlán highway), and as a disjunct in eastern Guanajuato (Fig. 2). In Chihuahua and Sonora, populations of the new species have been found from ca. 1825–2250 m in pine-oak forest and riparian forest dominated by *Pinus* spp., *Quercus* spp., *Cupressus*, *Abies*, and *Alnus*. At these sites, *A. jorgeana* occurs mainly in the shade of canopy trees in steep ravines and in canyon bottoms along perennial streams. At Pinos Altos, Chihuahua, the species was found on a disturbed hill with little topsoil in sparse vegetation dominated by *Juniperus*. This site is considerably more xeric than the

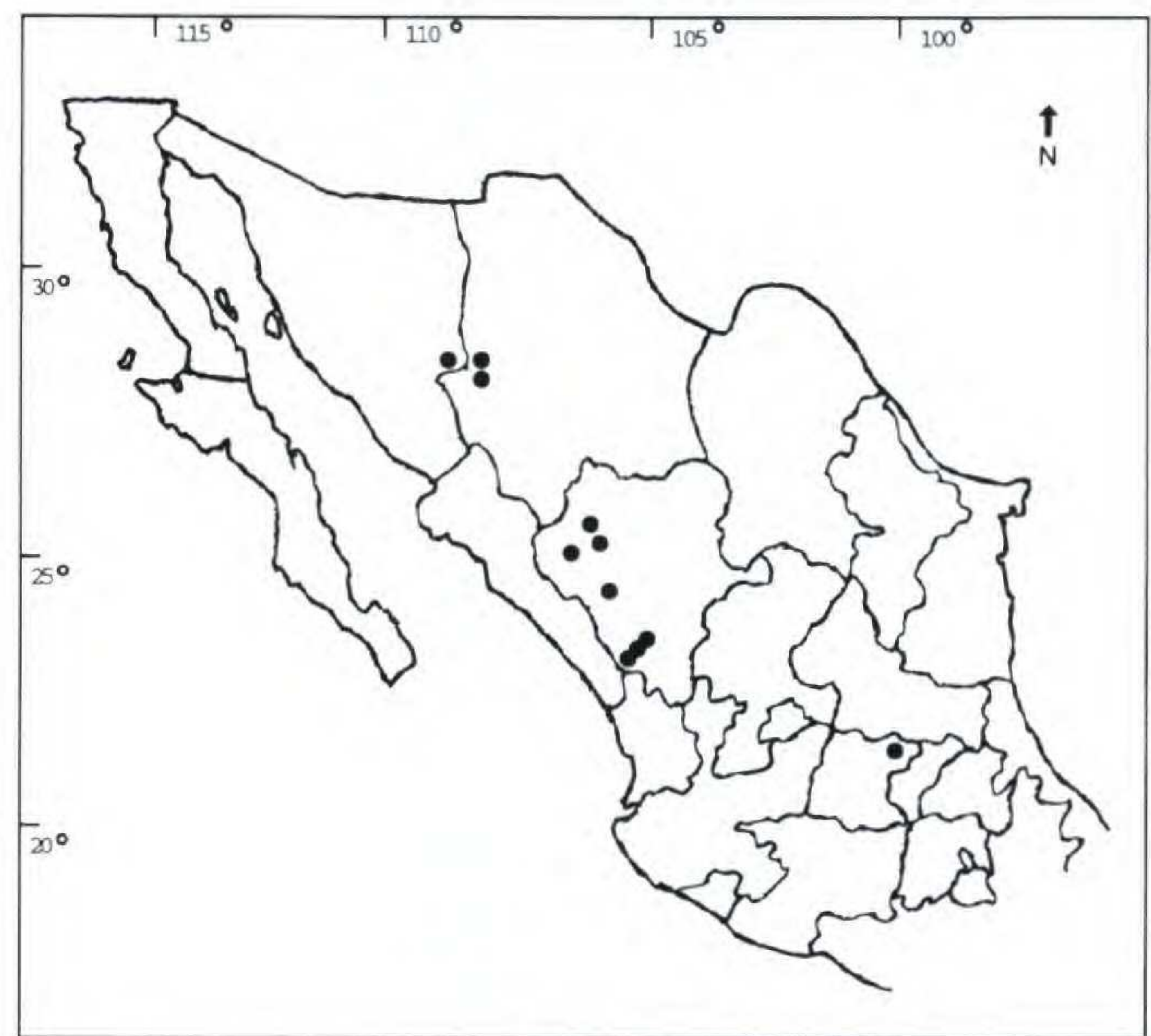


Figure 2. Distribution of *Asclepias jorgeana* in northern and central Mexico.

other known localities and is the site of the only previously collected population in the vicinity of Cascada de Basaseáchic that could not be relocated in 1994.

In Durango, populations of *A. jorgeana* have been found from ca. 1700 to 2525 m in a variety of vegetation types. At the lowest elevations, the new species has been collected at the lower limit of pine-oak forest at the ecotone with tropical deciduous forest or thorn scrub. Along streams at these elevations, it has been found in pine-oak forest with *Abies*. At middle elevations, it has been found in pine-oak forest on canyon slopes and in cloud forest with *Magnolia*. At the highest elevations, *A. jorgeana* has been collected in meadows within pine-oak forest and on steep slopes in mixed conifer forest with *Pinus*, *Abies*, *Cupressus*, and *Pseudotsuga*.

In Guanajuato, *A. jorgeana* has been collected on a hillside at ca. 1835 m. The vegetation at this locality was not reported by the collectors.

**Ecology and phenology.** *Asclepias jorgeana* is unusual among North American milkweeds by inhabiting dense forest understories rather than more typical open woodland and grassland sites. Other species of *Asclepias* that are found in similar habitats include *A. quadrifolia* Jacquin and *A. exaltata* L. in the eastern United States, *A. similis* Hemsley in eastern and southern Mexico, *A. hypoleuca* (A. Gray) Woodson (sympatric with *A. jorgeana* in Chihuahua and Sonora), and *A. ovata* M. Martens & Galeotti. Presumably these species are tolerant of the shade and acidic soils characteristic of these habitats. Unlike *A. quadrifolia*, *A. exaltata*, *A. similis*, and *A. hypoleuca*, which possess large storage roots that may be advantageous to plants of the for-



est understory (Chaplin & Walker, 1982; M. Fishbein, pers. obs.), *A. jorgeana* has fibrous roots, like *A. ovata* (M. Fishbein, pers. obs.). Despite the lack of large roots, individual plants of *A. jorgeana* have persisted for several years in cultivation (M. Fishbein, unpublished data).

Based on label data, flowering dates for the new species range from late June through August. Southern populations in Durango appear to have a more extended flowering season lasting through August, whereas the latest flowering specimens from Chihuahua were collected on the first of August. Fruiting specimens in Chihuahua and Durango have been collected in mid August.

Several kinds of insects have been observed visiting the flowers of *A. jorgeana* in Chihuahua. Along the Arroyo Durazno, small butterflies of the families HesperIIDae and LycaenIDae were observed. The flowers emitted a strong violet-like scent when these observations were made on a warm sunny morning; during all other field observations, however, no scent could be detected. At several sites in Chihuahua, tiny Diptera or Hymenoptera were observed visiting flowers in great numbers. Among observed visitors, hesperiid and lycaenid Lepidoptera were probably marginally large enough to be effective pollinators of this species, although no pollinia were observed on these visitors (cf. effective pollinators of *A. tuberosa* L., which has flowers comparable in size and shape to those of *A. jorgeana* [Fishbein & Venable, 1996]). We have not observed flower visitors that we deem to be regular, effective pollinators of this species. The small flies were certainly too small to be pollinators, being approximately equal in size to a pollinium.

In Durango, woolly caterpillars (Lepidoptera: ArctIIDae) and Queen butterfly caterpillars (Lepidoptera: DanaIIDae) were observed feeding extensively on leaves and young fruit. No herbivory was observed at any of the sites in Chihuahua.

*Phylogenetic relationships.* *Asclepias jorgeana* has stipitate, cup-shaped corona segments that are similar to those of species included by Woodson in subgenus *Asclepias* (Woodson, 1941b, 1954). Within this subgenus, *A. jorgeana* is most similar to species assigned by Woodson (1954) to the heterogeneous series *Syriacae*, *Purpurascetes*, and *Tuberosae*. Among these, *A. jorgeana* is most similar to *A. pringlei* (Greenman) Woodson of series *Syriacae*. The two species are nearly identical in vegetative characteristics, and we have been able to determine only with great difficulty the identity of non-reproductive specimens from areas where the two species co-occur. However, the species are easily distinguished in flower or fruit. Flowers of *A.*

*pringlei* have smaller corona segments (hoods) with less attenuate and more rounded apices. The adaxial hood appendages (horns) of *A. pringlei* are less arching than those of *A. jorgeana* or may be absent altogether. Arching corona horns are present in all specimens of *A. jorgeana* that we have examined. Fruits of *A. pringlei* are distinctive: they are pendulous, ovoid, and have a thick spongy layer in the wall of the follicle. The seeds are also unusual in lacking the apical trichomes (coma) common to most species in the family (cf. *A. perennis* Walter of the southeastern U.S.). *Asclepias jorgeana* produces fruits that are more typical of those of other North American species of *Asclepias*: erect, relatively slender with a long, tapering apex, and thin-walled. The seeds possess a typical coma.

Other species with which *A. jorgeana* shares similar characteristics include *A. variegata* L. (eastern U.S.) and *A. hallii* A. Gray (southwestern U.S.) of series *Purpurascetes* and *A. tuberosa* (widespread in the U.S.) of series *Tuberosae*. *Asclepias variegata* is similar vegetatively, but differs in having compact hemispherical umbels and small hoods with rounded apices reminiscent of those of *A. pringlei*. *Asclepias hallii* is quite similar in floral morphology and coloration, but differs from *A. jorgeana* in bearing alternately arranged, narrowly lanceolate leaves. *Asclepias tuberosa* is also similar in floral morphology, but differs in having brightly colored yellow, orange, or red flowers, branched inflorescences, alternate phyllotaxy, lack of white latex, and densely hirsute vestiture.

Preliminary phylogenetic study of *Asclepias* based on a broad sampling of morphological characters suggests that *A. jorgeana* is a member of a large clade that includes the majority of species comprising subgenus *Asclepias* (Fishbein, 1996a, b, unpublished). Relationships within this large clade are poorly resolved in the analyses of Fishbein (1996a, b, unpublished), with members of series *Syriacae*, *Purpurascetes*, and *Tuberosae* intermingled. In the set of most parsimonious trees, *A. jorgeana* is usually found to be a member of a subclade containing *A. variegata*, *A. hallii*, and *A. tuberosa*. Placement of *A. jorgeana* in this subclade is supported by possession of an attenuate hood apex and appressed anther margins that tightly restrict access to the underlying stigmatic chamber. In some analyses, *A. pringlei* is found to be a member of a closely related subclade, and placement of *A. jorgeana* in the same subclade as *A. pringlei* is only slightly less parsimonious than placement in separate subclades (Fishbein, unpublished). The highly apomorphic fruit characters that readily distinguish *A. pringlei* from *A. jorgeana* do not link *A.*



*pringlei* with any other species. These characters clearly have arisen independently in other lineages, such as pendulous fruits in the desert shrub *A. subulata* Decaisne, and seeds lacking a coma in *A. perennis*. We consider it likely that more refined analyses of *A. jorgeana* and related species will find a closer relationship between *A. jorgeana* and *A. pringlei*.

Specimens of *Asclepias jorgeana* have been identified previously as *A. ovata*, which occurs sympatrically, but often at lower elevations and in more open habitats (e.g., *Spellenberg* 9603, NMC; *Gentry & Gilly* 10615, MICH; *LeDoux* 1947, ENCB; *Bravo* 1076, IEB). The two species share an erect, unbranched habit with sparse pubescence, ovate membranous leaves, fruits borne erect on deflexed pedicels, and fibrous roots. Compared to *A. jorgeana*, the umbels of *A. ovata* are nearly spherical, rather than flat-topped to nearly hemispherical, and the corona segments are bright white and apically truncate, rather than pale lavender and apically attenuate. Specimens of *A. jorgeana* have also been identified as *A. contrayerba* Sessé & Mocino (= *A. jaliscana* B. L. Robinson; *Maysilles* 7434, MO), *A. glaucescens* HBK (*Warnock* 2156, TEX 2 sheets), and *A. lanuginosa* HBK, non Nuttall (= *A. otarioides* E. Fournier; *Waterfall* 13654, MO). *Asclepias jorgeana* has not been confused with *A. pringlei* by collectors, despite vegetative similarities, probably because they are easily distinguished in flower and fruit. Some specimens of *A. jorgeana* have been determined to represent an undescribed species (e.g., *Pennington* 93, TEX; *Tenorio* 1150, ENCB 2 sheets, MEXU).

Specimens attributable to *A. jorgeana* also have been considered to represent hybrids. A specimen of *A. jorgeana* examined by Woodson (*Maysilles* 7434, MICH) was annotated initially as a putative hybrid between *A. otarioides* E. Fournier (as *A. lanuginosa* HBK) and *A. pringlei* (as *A. humilis* (sic), i.e., *Acerates humilis* Benth; see Woodson, 1954: 123). Woodson later determined specimens of *A. jorgeana* to be hybrids between *A. otarioides* and *A. ovata* (e.g., *Maysilles* 7852, MICH; *Maysilles* 7860A, MICH; *Maysilles* 8477, MICH). The similarities of *A. jorgeana* to *A. pringlei* and *A. ovata* already have been discussed. However, we find no compelling reason to invoke the parentage of the rather dissimilar *A. otarioides* in the origin of *A. jorgeana*. No evidence of intermediacy exists in locations where *A. jorgeana* is sympatric with *A. otarioides* and *A. pringlei* in Durango or with *A. ovata* throughout its range. We cannot disprove the hybrid origin of *A. jorgeana* with existing data. However, the species is clearly composed of self-reproducing

populations with no evident gene flow from the putative parents.

Of other specimens that Woodson (1954: 123) suggested to be part of hybrid swarms between *A. otarioides* and either *A. ovata* or *A. pringlei*, some have been recognized as representing a distinct species, namely, *A. notha* W. D. Stevens (Stevens, 1983, 1985). Others should perhaps be recognized as an additional species endemic to Michoacán, viz., *A. scheryi* Woodson (Woodson, 1941a). Woodson (1954) subsequently included these specimens in his concept of *A. lanuginosa* HBK (= *A. otarioides*). Most of the remaining specimens considered by Woodson (1954) to belong to this complex of putative hybrids were collected in Puebla and Oaxaca and appear to represent yet another species (S. Lynch, unpublished data). Although it may be surprising that a new species of *Asclepias* should be described from North America, it is evident that several more will be named from relatively poorly collected areas in the rugged Mexican sierras.

*Paratypes.* MEXICO. **Chihuahua:** Cascada de Basaseáchic, 28°10'20"N, 108°13'W, 2000 m, top of falls, 23 July 1986, *P. Jenkins s.n.* (ARIZ); 28°11'W, 108°12'30"N, in sand along the Río Basaseáchic between the campground and the top of the falls, 1 Aug. 1988, *R. Spellenberg* 9603, *R. Corral, J. Brunt, L. Huenneke* (NMC); Pinos Altos, on trail from Santo Niño shaft to lower tunnel, 28°15'N, 108°17'W, 2075 m, steep moist, W-facing andesitic cliffs, 21 July 1946, *W. P. Hewitt*, 144 (TEX); 28°16'20"N, 108°18'10"W, 2250 m, 26 July 1986, *G. Ferguson s.n.* (ARIZ); 1.5 mi. NW of Pinos Altos along road to La Batería, 28°16'40"N, 108°18'40"W, 2100 m, tall pine-oak forest, 27 June 1986, *G. Ferguson s.n.* (ARIZ); 2.0 mi. NW of Pinos Altos along road to La Batería, 28°16'40"N, 108°18'40"W, 2025 m, steep, rocky, N-facing ravine in pine-oak forest, 6 July 1994, *M. Fishbein* 1804, *S. McMahon, G. Ferguson, R. Felger, M. Wilson* (ARIZ), 19 Aug. 1994, *M. Wilson s.n.* (ARIZ); Arroyo Durazno at La Batería road crossing, 28°17'30"N, 108°20'W, 1730 m, fir-alder riparian forest, 28 June 1986, *G. Ferguson s.n.* (ARIZ, MO); near river in shade of oaks and pines, 27 July 1988, *P. Jenkins s.n.* (ARIZ); Arroyo Durazno, approx. 2 km upstream from La Batería road crossing, 28°17'N, 108°20'W, 1730 m, riparian forest, 7 July 1994, *M. Fishbein* 1826, *S. McMahon, G. Ferguson, R. Felger, M. Wilson* (ARIZ, MO); Lagotera, 1525–1825 m, 21 July 1965, *C. W. Pennington*, 93 (TEX). **Durango:** Coyotes Hacienda, 63 road mi. W-SW of Cd. Durango, 2400–2500 m, open meadows in pine forests, 26 July 1950, *J. H. Maysilles*, 7434 (MICH, MO), 16 July 1955, *J. H. Maysilles*, 7852, 7860A (MICH), 10 Aug. 1955, *J. H. Maysilles*, 8477 (MICH); just SW of Coyotes Hacienda, slight NE-facing slope, edges of pine woods, 25 Aug. 1980, *M. J. Warnock* 2156, *S. McCormick, J. Norris* (TEX 2 sheets); 10–12 mi. W of La Ciudad (38–40 mi. W of El Salto); Mazatlán–Durango Rd, 2525 m, steep, moist canyon slope in pine-oak forest, 15 June 1951, *H. S. Gentry & C. L. Gilly*, 10615 (ARIZ, MICH); 5.5 mi. E of El Salto, about 55 mi. SW of Durango, open pine-oak woods, 12 Aug. 1957, *U. T. Waterfall* 13654, *C. S. Wallis* (MO); 6.0 mi. NE of El



Salto, along Hwy. 40, 2300 m, pine-oak forest, 10 Aug. 1994, S. P. Lynch 14175 (LSUS); hill overlooking town of Llano Grande, 32 mi. W of Durango, on sandy loam, 22 July 1975, D. LeDoux & Dunn 1947 (ENCB, LL, MO, NY); Mpio. El Salto, "El Capulin," al 4 km noroeste de El Pueblo de 1010, bosque pino-encino, suelo negro forestal, 28 jun. 1982, P. Tenorio L. 716, C. Romero de T. (MEXU); 2 km al oeste de Revocaderos, Carr. Mazatlán-Durango, 2100 m, cañadas escarpadas, bosque mesófilo de montaña, 26 jul. 1989, A. Vázquez 4905, R. Alvarez (IEB, LSUS, WIS); Mpio. Tepehuanes, Cerro Boludo, Sierra de la Candela, 20 km al este de Tepehuanes, 1700 m, 21 jul. 1982, R. Hernández M. 8111, et al. (MEXU, TEX); 18 km al noroeste de Tepehuanes, bosque pino-encino, suelo negro forestal, 21 jul. 1982, P. Tenorio L. 1150, C. Romero de T. (ENCB 2 sheets, MEXU, MO); 9 km al este de Tabahueto, camino a Tepehuanes, ecotonía de selva baja caducifolia y bosque de pino-encino, alterado, suelo pedregoso, 31 ago. 1983, R. Torres C. 3586, P. Tenorio L., E. Torrecillas (MEXU, MO 3 sheets); Mpio. Tayoltita, El Pino, 20 km de el entronque a Sapioris con la Brecha Coyotes-San Miguel de Cruces, 24°31'N, 105°49'W, 1860 m, ecotonía bosque de pino-matorral espinoso, 8 jul. 1984, P. Tenorio L. 6319, C. Romero de T., T. P. Ramamoorthy (MEXU, MO); Mpio. Canelas, predio particular Las Cebollitas, 1 ago. 1990, O. Bravo B. 1076 (IEB). **Guanajuato:** Mpio. Atarjea, Cucillos, 2300 m, ladera de cerro, vegetación boscosa, 14 jul. 1990, E. Ventura & E. López 8285 (IEB). **Sonora:** Mpio. Yécora, El Divisadero (El Bordo), 1 km SE of El Llano on road to Bermudez, Mesa del Campanero, 28°19'41"N, 109°02'38"W, 2100 m, pine-oak forest, 14 July 1997, T. R. Van Devender 97-647, A. L. Reina, R. L. Belsey, D. Larson, M. J. Martínez C., P. Larson, A. Búrquez M., M. Quintana (ARIZ).

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